

## **Lightning and Severe Weather Protection**

Several of our NASA Centers are located in areas that have frequent severe weather where lightning strikes, hail storms, and hurricane force winds occur every year. If your job takes you outdoors, whether to transport spacecraft, or just to walk the parking lot, remember a few tips for the weather. Lightning and severe weather potentially create harmful conditions for employees and our high value assets.

As stewards of some of the most sophisticated and unique hardware in the world, each NASA employee should take lightning safety training. The importance of personal lightning safety must be passed along to each and every employee, including contractors, at all NASA Centers.

We need to be aware of, and practice some common sense approaches to lightning safety. When outside, keep an eye on the sky. Look for darkening skies, flashes of light or increased wind. Listen for thunder. Remember if you can hear thunder, you are close enough to be struck by lightning and should seek shelter in a building or car immediately. If caught outdoors in an open area, make yourself a small target by squatting low to the ground. Do not lie flat on the ground. If you are outdoors in a wooded area take shelter under shorter trees. If indoors during a lightning storm remember telephone lines and metal pipes conduct electricity. Avoid taking a bath or shower or running water for any purpose. Unplug or turn off high value equipment, air conditioners, or appliances that may be damaged by power surges. Together, with simple precautions, we can reduce the risk of personal injury and equipment damage during a lightning storm.

I am asking every NASA Center and every NASA Directorate, to evaluate their operations and determine how to minimize the possibility of exposures to lightning while

visiting or conducting business. If we can determine whether a potential for exposure exists, then we can mitigate the exposure risk.

## **NASA Actions**

### ***Principal Center***

- Distribute National Oceanic and Atmospheric Administration bulletin on severe weather

### ***NASA Centers***

- Evaluate operations and determine if employees or members of the general public could possibly be exposed to lightning while visiting or conducting business
- Provide education and training
- Review and update lightning warning procedures
- Provide alternative notification for hearing impaired employees

## Background

At any given moment, more than 2,000 thunderstorms occur around the world.. These storms combine to produce approximately 100 lightning strikes per second, with each strike having the potential of up to one billion volts. Electrical currents range in excess of 200,000 amperes and generate temperatures in excess of 54, 000 degrees Fahrenheit<sup>1</sup>. A moderately sized thunderstorm routinely generates several hundred megawatts of electrical power, enough energy to equal the output of a small nuclear power plant. With so much energy being both generated and unleashed, it is obvious why lightning poses such a significant potential for serious injury, death, and devastating property loss. Each year in the United States alone, approximately 93 Americans are fatally struck by lightning. An additional 300 lightning related injuries are reported<sup>2</sup>. Property losses from lightning easily exceed several hundred million dollars each year<sup>3</sup>.

According to the Federal Aviation Administration, commercial aircraft are struck by lightning about once every 3000 hours of flight. Spacecraft are reportedly more vulnerable to lightning strikes than aircraft. In November 1969, lightning struck the Apollo 12 spacecraft<sup>1</sup> just seconds after launch. The strike temporarily disabled electrical systems jeopardizing the crew and mission. Another catastrophic example occurred in March 1987, when an Atlas/Centaur rocket and its payload were lost to a lightning strike. Earlier this year, the launch of STS-93 with NASA's first female commander, Eileen Collins, was delayed due to severe thunderstorms and lightning within close proximity to the launch area and the Shuttle Landing Facility.

Most Centers have an active adverse weather and lightning protection programs in place that define potentially hazardous situations, identify early warning systems and delineate personnel actions. Continuous evaluations and improvements in these systems must be made to ensure that they are operating as designed. In instances where lightning protection systems are deemed ineffective or outdated, immediate steps should be taken to update these systems to minimize the potential harm to employees and damage to NASA's equipment and resources.